

Computational and Applied Mathematics 3321 – Statistics

Student Learning Outcomes

- 1. Students will demonstrate factual knowledge including the mathematical notation and terminology used in this course.** Students will read, interpret, and use the vocabulary, symbolism, and basic definitions used in statistics including definitions of measures of central tendency; standard deviation; standardized variable; regression line; coefficient of determination; normally distributed variable; sampling distribution of the mean; sampling distribution of the proportion; point estimate; confidence interval estimate; null hypothesis; alternative hypothesis; critical value; and test statistic.
- 2. The students will describe the fundamental principles including the laws and theorems arising from concepts covered in this course.** Students will identify and apply the laws and formulas that result directly from the definitions; for example, calculation of measures of central tendency; standard deviations; coefficients of determination; critical values and test statistics. Additionally, the students will apply theorems such as the Central Limit Theorem.
- 3. The students will apply course material along with procedures and techniques covered in this course to solve problems.** Students will use the facts, formulas, and techniques learned in this course to find regression equations for data collected; use regression equations to make predictions; calculate probabilities; find confidence intervals for means and proportions; and perform a variety of hypothesis tests.
- 4. The students will use available statistical software packages to solve problems.** Students will use appropriate packages to solve problems in both descriptive and inferential statistics. Additionally, the students will use software to represent data visually.
- 5. The students will develop specific skills, competencies, and thought processes sufficient to support further study or work in this field or related fields.** Students will acquire a level of proficiency in the fundamental concepts and applications necessary for further study in academic fields requiring statistics as a prerequisite, or for work in occupational fields requiring a background in statistics. These fields might include medicine, education, social sciences, and psychology.

Course Content

Textbook: *Introductory Statistics*, Ninth Edition, by Neil A. Weiss. The following chapters including the particular sections listed are covered. (See textbook “Contents”)

- 1. The Nature of Statistics.** Classifying statistical studies; sampling procedures.
- 2. Organizing Data.** Grouping data; graphs and charts; distribution shapes; misleading graphs.
- 3. Descriptive Measures.** Mean; median; mode; standard deviation; quartiles; percentiles; deciles; boxplots.
- 4. Probability Concepts.** Events; conditional probability; Bayes’ formula; counting.
- 5. Discrete Random Variables.** Mean and Standard Deviation; binomial and Poisson distributions.
- 6. The Normal Distribution.** Areas under the standard normal curve; normally distributed variables; normal probability plots.
- 7. The Sampling Distribution of the Mean.** Sampling error; mean and standard deviation of the sampling distribution of the mean.
- 8. Confidence Intervals for One Population Mean.** Calculate confidence intervals for the mean; margin of error; sample size.
- 9. Hypothesis Tests for One Population Mean.** Set up hypothesis tests; errors; perform hypothesis tests; P-values; type II errors; probability; the Wilcoxon signed-rank test.

10. **Inferences for Two Population Means.** Hypothesis tests; the Mann-Whitney test.
11. **Inferences for Population Standard Deviation.**
12. **Inferences for Population Proportions.** Calculating confidence intervals for one population proportion; performing hypothesis tests for one population proportion.
13. **Chi-Square Procedures.** Chi-Square Goodness-of-Fit Test; Chi-Square Independence Test.
14. **Descriptive Methods in Regression and Correlation.** Regression equation; coefficient of determination; linear correlation.
15. **Inferential Methods in Regression and Correlation.** Inferences in correlation; testing for normality.
16. **Analysis of Variance.** The F-Distribution, One-Way ANOVA

Additional Topics. Multiple regression analysis; Design of experiments and analysis of variance.